GARDNER

Engine Forum

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Gardner Engine Forum Philosophy

"The aims of the Forum are to promote and foster interest in all Gardner engines"

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Forum Officers

Chairman: Colin Paillin
Ivy Cottage, 11 The Green, Hose,
Melton Mowbray, Leics. LE14 4JP
(Tel: 01949 869004)

Treasurer: Judith Gray 29 Verity Walk
Wordsley Stourbridge West Midlands DY8 4XS
Tele 01384 75171

Membership Secretary: Bob Heath,
6 Musgrave House, Bamford Mill, Bamford,
Hope Valley, Derbyshire. S33 0AU

Secretary-Editor-Webmaster:Steven Gray 29 Verity Walk, Wordsley, Stourbridge, West Midlands. DY8 4XS
Tele 01384 75171

Contents

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Cover Picture

3L3 Marine
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Chairman's Jottings

By the time that you receive this newsletter, Christmas and the New Year will be long gone, we are sorry for this very late issue,it should have landed on your doormat before Christmas, but we received disappointing news that Gardner Parts would not be supporting us at the next rally in June.

I personally feel very deflated and not having the presence of Gardner Parts does hang very uneasy with me, The staff are happy to spend a weekend with us (unpaid) but the commercial director of Leyland Exports feels that as the rally generally only covers the smaller end of the market and with a diminishing road transport usage this now only represents a very small portion of their business. (the main customers are now the overseas marine market), but without the branches the trees will die, after receiving this news, it was decided that we would hold a committee meeting to determine wether we should continue and organise a rally.

Having had a committee meeting we decided to continue and organise a rally and determined that we would one again return to the same venue as the 2007 rally at Park Head, Dudley. I can hear you sound disappointed that this will be the same venue as before. It is becoming increasingly difficult to find sites that can accommodate Commercial Vehicles, Stationary Engines,Canal & River Craft, the site at Milton Keynes was investigated but was found to be a difficult site to organise, and not completely ideal.

On a lighter note ,I have friend with a tug (which has an air cooled Lister),during a telephone conversation I comment that I cannot start my Gardner, he in return sends me a Christmas present to help out, a tin of Bradex Easy Start. That's gone home. (cannot have that in the engine room)

I read in the Russell Newbury newsletter that Gardner spares are very difficult to obtain and are now classing Gardner with Lister in this respect, in fact I was asked by a friend,what was I going to do for spares?. I think that my engine (4L2) having been rebuilt with new mains,big & little ends, new liners and pistons will see me out after all its only 77 years old now.

The next A.G.M has been arranged for 2.30pm on the 18th April, at the Anson Engine Museum,if you can please attend, if you can please let me know as we have to give the museum an indication of numbers.

I have said that I feel that we need a new chairman as I have been in this position since the inception of the Forum and would like to pass on the mantle to some one new, if no new faces come forward I feel that we must consider winding up the forum at the next A.G.M.

A belated happy new year to you all.

Colin Paillin

WHO AM I?

I was born at Barton Hall,Eccles,Manchester on January 10th,1941 as a Second World War “babe” and branded with the permanent identity number BB4807 and 387Z. These numbers must provide some positive form of evidence to my true identity , however, strangely when I arrived it was from the port side (left) of the womb. One wonders if there was a starboard mate
for company. In other words, was I one of a pair?

I was certainly a “big boy” at birth, in fact all nine litres in Gardner terms and classified as the perfect 3L3 model. Bearing in mind
it was during war years when times were very difficult, one now wonders if perhaps I’d developed as a “one off” from scraps and left overs of a production run! Never the less I was very much wanted, in fact needed as efficient cheap slave labour to help drive the world forward. But times were hard and as a young ‘un

I was totally abused to the point of being almost drowned. (These are unconfirmed thoughts). I became unwanted, forgotten and left abandoned for a number of years during which time, life was a rapid deterioration due to sheer neglect. Even Jack Frost came and took a nip at me. Ouch, that was very painful! Eventually some cowboys got hold of me and decided to mess me about,
you know, the “bodge it and scarper brigade”, now they’re cruel. Like a haggard old dog, I simply lay down and refused to run any longer, their big stillsons, hammer and long crowbars did no good whatsoever. What I really wanted was TLC.

The question still remains, who am I?
Have a good look at me on the front cover and see if you spot any oddities.

To be continued.....

P J Freakley

The Starter Motor Continued

Field Coils.—These can be simply tested when in position for short circuits to the yoke and poles by means of hand spikes connected to a mains
supply and in series with a lamp of suitable voltage positioned on the live side of the system. One spike should be applied to the end of the winding and the other to the yoke at a suitable position where it is free from enamel and insulation. If the lamp does not light, then the insulation is intact. Take care to first remove all other connections to the coils and to insulate any bare ends.

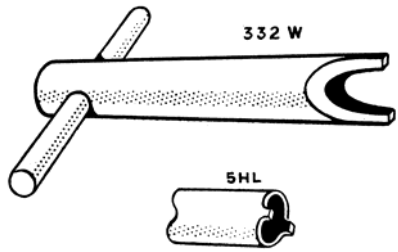


Fig. 303.—Special Tools for Dismantling the C.A.V. Axial Starter.

Internal shorts can be traced by means of an ohm-meter. As the resistance of the coils should be within 6 per cent. of each other, the most satisfactory method is to compare for excessive variation of the suspected coil with each of the remaining individual coils in the set. It will generally be found that the total resistance of C.A.V. main starter field coils will be from 0.001 to 0.003 ohm,approximately, per set, for 6-,I2-,and 24-volt machines.

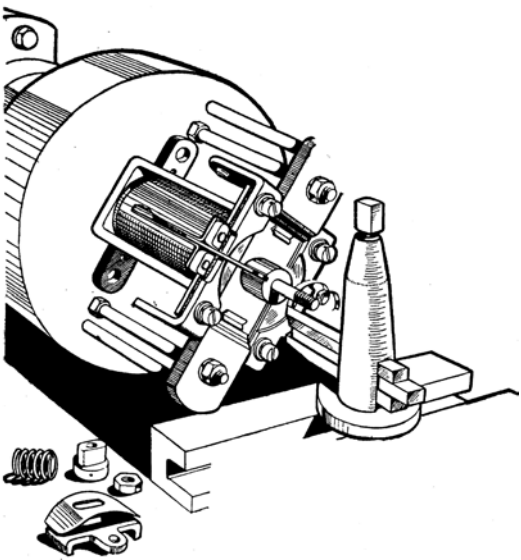


Fig. 304.—Method of Refacing Solenoid Switch Contacts.

Dismantling Axial Starter.—

Special Tools for Dismantling.—To facilitate the dismantling of C.A.V. axial starter motors two special tools have been devised, namely the types 332W and 5HL shown in Fig. 303. Type 332W tool is employed for the motor armature spring nut and regulator adjustment.

The tool 5HL is used for the armature plunger nut. There is another somewhat similar tool. Type 842X, that is used for another model starter.In connection with these tools, the detailed step-by-step instructions of the manufacturers, a copy of which can be obtained on application to the firm should be followed. The lettered sectional illustration reproduced in Fig 293 will also be found very useful when dismantling and reassembling the starter.

The method of extracting the C.A.V. axial starter oil-less bearing bush is shown in Fig 302. A standard 1in. B.S.F. tap and a steel rod off 3/8 inch diameter by 7 1/2 in. long are all that are required. After removing the pinion spring and saddle, drop the steel rod into the cavity and then tap into the bush until the tap bottoms on to the rod. Continue turning the tap wrench, when the bush will be slowly forced out.

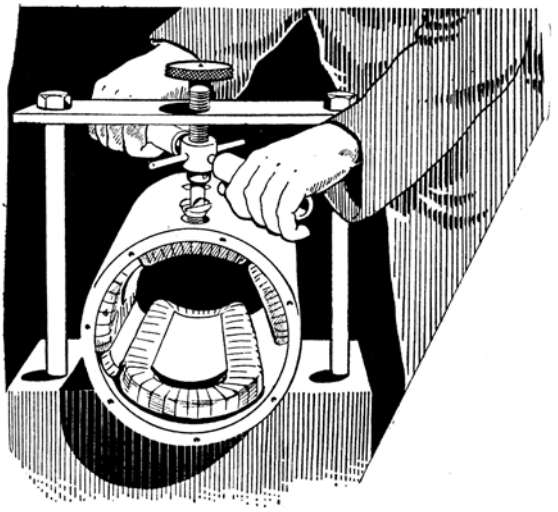


Fig. 305.—A Device for Unscrewing C.A.V. Pole-piece Screws.

Fig- 304 illustrates the method recommended for refacing the solenoid switch contacts of the C.A.V.axial starter by mounting them in a lathe and turning them with a suitable lathe facing tool. New contacts may be trued in the same manner.

The method of removing and refitting the pole pieces of dynamos and starters is illustrated in flg 305. The rig shows how powerful effort is applied to the flush headed screws holding the pole pieces, using the screw-down screwdriver blade arrangement shown It is very important to screw the pole pieces down tightly to avoid armature failure, by fouling these items.

Changing Starter Pinion

It is possible to change the C.A.V. starter pinion without dismantling the starter motor by removing the split pin and slotted nut from the armature shaft (Fig. 306), after which the motor is stood on end with the pinion above. The thin shaft nut is

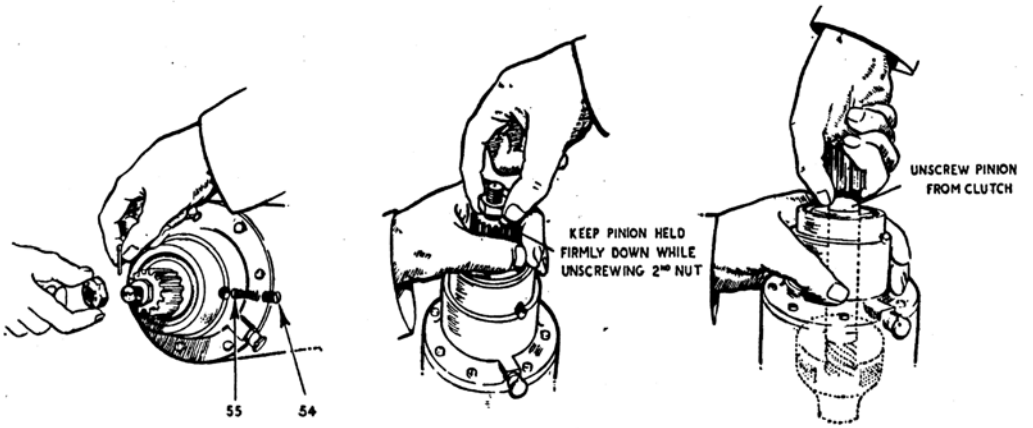


Fig. 306—Method of Removing Starter Pinion without Dismantling Starter Motor.

loosened, whilst keeping the pinion held firmly against its spring pressure plate. Then, whilst still keeping resistance against the spring, the pinion should be turned in the opposite direction to that of normal rotation, pressure being gradually released until the pinion is unscrewed.

Operation of Axial Starters

The following notes, in the form of operational instructions, should be observed carefully when using axial starters:
Make sure all engine controls are correctly adjusted.
Release the switch as soon as the engine fires.
If the engine does not fire at once, allow it to come to rest before pressing the starter switch again.
Do not use it continuously if the engine does not start. Ascertain the cause of failure.
With some engines it is often helpful to depress the clutch when starting.
On no account should it be operated while the engine is running, otherwise serious damage is likely to occur to both starter and flywheel teeth.

General Maintenance Notes for Starters

The following instructions apply to C.A.V. starters of different types and are in the form of *"-Do Not*" instructions.

Do Not.-Attempt to rebore the poles or re-machine armature core, as this will upset the engaging action of the starter.

Use other than proper brushes, as in correct grades will mean excessive sparking,resulting in bad commutator surface and pitting.

Use lubricants other than those mentioned unless they have been submitted to the manufacturers for approval. Incorrect lubricants will cause excessive bearing wear.

Damage armature core when holding it for torque test of clutch, as short circuits in the windings may occur or the air gap between poles and armature may be affected.

Bend or damage switch tripping plate on armature, otherwise the timing of the pinion engagement will be altered.

Let oil or dirt come in contact with the commutator, since this will cause short circuits between the commutator bars, uneven brush wear, a bad commutator surface, and breakdown of insulation.

Be over-enthusiastic with lubricant in the driving-end lubricator.

Oiling is very necessary, but if excessive, saturated windings will result and cause premature breakdown of the insulation.

C.A.V. Non-axial-type Starters

This type of electric starting motor is a simple series-wound motor fitted with a special pinion gear for easy engagement with the teeth on the flywheel rim. The method of drive varies slightly, according to the particular requirements, but the majority of commercial types have a quick-start threaded sleeve mounted on the main shaft along which the freely-mounted pinion travels into engagement with the engine flywheel.

The actual shock of engagement is absorbed through a large-section coil spring. Oilless bearings are fitted on the latest models, dispensing with the necessity for periodic lubrication by the user.

When ordering spares or fittings, particulars of the motor as given on the name plate should be quoted.

Fitting Non-axial Starters. When fitting non-axial starters to motor-vehicle engines the following information may be found useful:

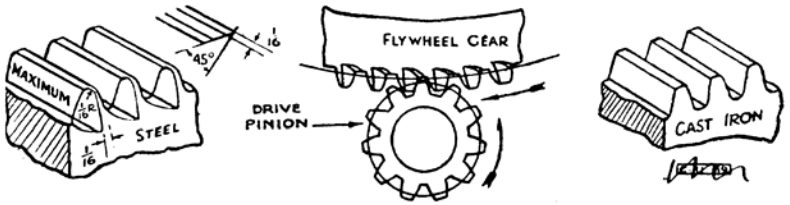


Fig. 307.—Flywheel Construction and Teeth Chamfering.

With cast-iron flywheel gears it is unnecessary to provide any chamfering or rounding of the teeth, and they may be left exactly as finished by the gear cutter. There must be no radius on the corner of the gear blank

When a steel gear ring or a material having the malleable characteristics of steel is utilised, it is necessary that the teeth be chamfered on the non-pressure side at an angle of 45° and intersecting the end face of the tooth in a line approximately parallel to the pressure side and 1/16in. (1.6mm.) there from Fig. 307. There may be a radius of 1/16in. (1.6 mm.) on the corner of the gear blank, and it is recommended that the whole ring be so treated as to have a scleroscope hardness in excess of 55 after mounting.

The stub-tooth form is used with a pitch of 8/10 and a pressure angle of 20°.

Maintenance of Non-axial Starters.—The following information,

whilst of general application to most designs of electric starting motor, is of particular interest to C.A.V. starter users:

Whilst very little attention is necessary, in order to provide for the longest possible trouble-free life the following items should be inspected at periods depending upon service conditions:

(a) Armature.—The commutator should be examined approximately every 25,000 miles or 6 months.

For full particulars of armature maintenance refer to General Instructions section

(b) Drive.—The screwed sleeve should be cleaned with paraffin and lubricated with thin machine oil, so that the pinion is perfectly free in travel. The pinion teeth must not be damaged or worn. Where a light pinion return spring is fitted this should be examined. On pinions with counter-weights the small retarding plunger should operate quite freely.

(c) Brush Gear.—The brushes should be examined about once every 25,000 miles or at six-monthly road running intervals. See that the band cover is correctly replaced after brush inspection. The general notes on the brush gear and its maintenance given under " Axial Starters " are equally applicable to " Non-axial Starters."

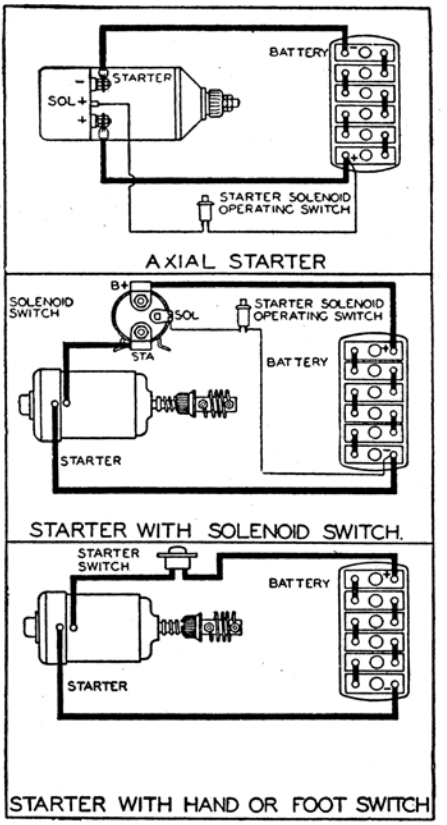
(D) Terminals.—Keep all nuts tight and clean. Where rubber caps are fitted to cover the terminals they should not be dispensed with when connecting the cables; they are supplied as a safety factor. Polarity of the terminals is unimportant except on machines with solenoid switches mounted directly on the yoke; here the terminal markings must be adhered to.

(c) Lubrication.—Unless a greaser is provided no attempt should be made to oil or grease the bearings. When lubrication is provided for, a soft grease as used for chassis lubrication is recommended.

(d) Bearings.—Worn bearings should be replaced and not rebored. The makers undertake to remove and refit bearings to the original precision standards.

Starter Circuits for Commercial Vehicles

The 12-volt starting motor is used for the lighter and 24-volt motor for heavier vehicles, but the actual starter electrical circuit is the same for each type and is independent of the other circuits on the vehicle, e.g. ignition, charging, lighting and accessory supply circuits. The starter takes its electrical supply direct from the battery and this supply does not pass through the ammeter. The reason for this is that the ammeter is fitted to show the battery charging current, from the dynamo and also the discharge



current when the lights are all switched on and the engine is idling, etc.

The current readings seldom exceed 10 to 15 amperes under these circumstances, whereas if the starter current supply was to be indicated on the ammeter it would require an instrument reading to several hundreds of amperes, thus leaving far too small a scale for the dynamo charging circuit readings. In any case, it is unnecessary to read the starter current, since if the battery is not sufficiently charged to start the motor, this fact is at once evident.

The circuit for the starter is a simple one, the battery and motor being wired in series. The starter switch in the lighter types of motor is in series with the battery and motor. In the heavier types, e.g. the axial starter,the starter solenoid switch is wired as shown in Fig. 308 (upper diagram).

When a non-axial starter circuit is fitted with a solenoid switch the, wiring is as shown in the central diagram of Fig. 308. The lower diagram shows the, usual light model starter with ordinary starter switch wired in series.

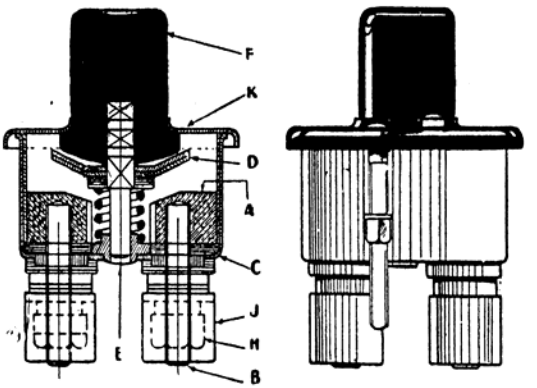


Fig. 309.—The C.A.V. NZ-type Starter Switch for Hand or Foot Operation.

Switches for Starters

Two switches are employed,.namely, the direct-action and the solenoid ones. In either case the contact members are of able area' since very large currents must flow through them during the initial starting operation of the motor.

Fig. 309 illustrates the C.A.V.NZ-type starter switch for foot or hand operation and is intended for the smaller class of starters (up to 41/2 in outside diameter).

Two heavy copper contacts "A" screwed on to the actual terminal studs "B" are contained within the pressed-steel body.

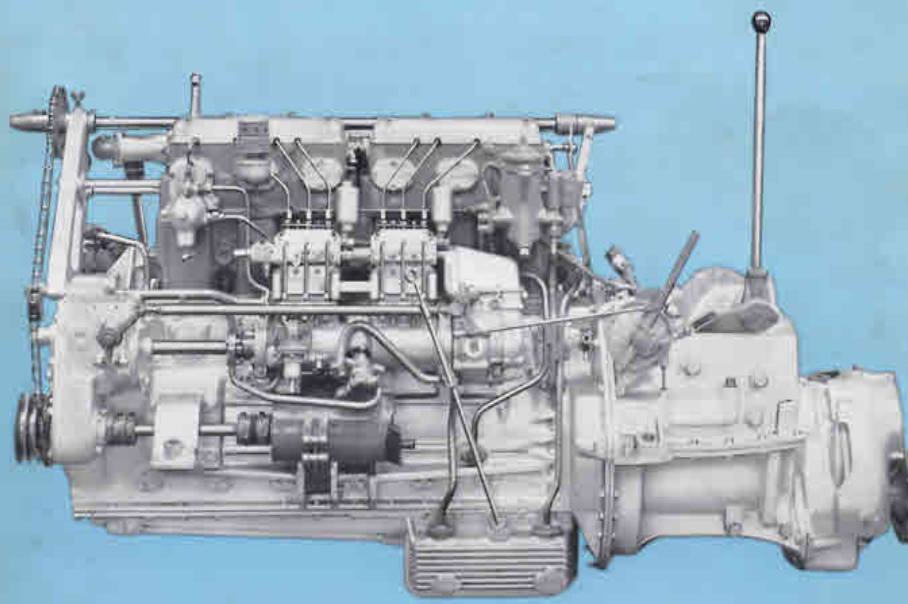
Continued on page 16

GARDNER 6LX

MARINE PROPULSION DIESEL UNITS

with 2.U.C. REVERSING and REDUCING GEARS

for Heavy Duty Commercial Craft, Fishing Boats, Yachts, Cruisers, Customs Launches, Police Boats, Work Boats, High Speed Craft etc.



6LX Marine Propulsion Engine with Hand Starting and Electric Starting Equipment

A unit of highest efficiency, quality and durability with exceptional power-to-weight and power-to-bulk ratios for all marine duty

This outstanding six cylinder 10·45 litre engine has, in conjunction with the Gardner No. 2 unit construction reversing and reversing-reducing gear, been developed as a Marine Unit. It offers the greatest degree of Efficiency, Durability and Refinement and has exceptional Power-to-weight and Power-to-space Ratios consistent with established GARDNER standards of dependability.

The minimum specific fuel consumption rate of the engine when directly coupled to a dynamometer is the remarkably low value of 0·330 lb./per b.h.p./hour which represents an overall thermal efficiency of no less than 39·73%. If the engine is operated slightly below maximum torque it does attain over 40% thermal efficiency.

The unit occupies the same space as the well-known 6LW engine and is, in fact, interchangeable with respect to mountings. It is quiet and smooth in operation to a degree not previously attained.

The well-proved GARDNER No. 2 unit Construction Reversing and Reversing-Reducing gear has been developed to transmit the increased power of the 6LX engine and the combined unit offers greater power in a given space than hitherto. It is offered as a direct-drive unit or with 2:1 or 3:1 reduction to propeller shafting. The helical reduction gears are of liberal diameters and face width.

The engine is designed for use with a fresh water closed-circuit heat exchanger or keel cooler system. Cooling water is circulated at high rate by a centrifugal pump and temperature is thermostatically controlled at all loads and speeds from idle to maximum output.

The unit has been accepted by LLOYDS for highest classification.

DESCRIPTION

The 6LX Marine Propulsion Diesel Engine is of the direct injection 4-stroke type having one inlet and one exhaust valve per cylinder located vertically in the cast-iron cylinder heads, one on each side of the GARDNER multi-hole fuel injectors. The valves are operated in orthodox manner by cams, levers, push rods and tappets from the main camshaft. Each inlet and exhaust cam is made as a unit and can be removed from the camshaft.

The camshaft is driven by a triplex bush, endless roller chain running in a constant stream of lubricating oil which, together with carefully spaced sprockets, ensures a smooth drive giving perfect reliability, long life and silent operation. The cylinder heads comprise two three-cylinder units.

The fuel injection pump and governor assembly is operated by a GARDNER camshaft, cams and tappets, the complete unit being trunnion mounted and in permanent alignment. It is gear driven from the valve camshaft. Hand operated levers are fitted to the fuel injection pumps. These enable easy priming of the fuel system. They also enable the fuel sprayers to be tested, either when in normal working position or when removed from the cylinder heads. The timing of fuel injection is automatically varied with engine speed. Lubricating oil circulates through an engine mounted oil cooler, a separate gear type oil pump being fitted for this duty.

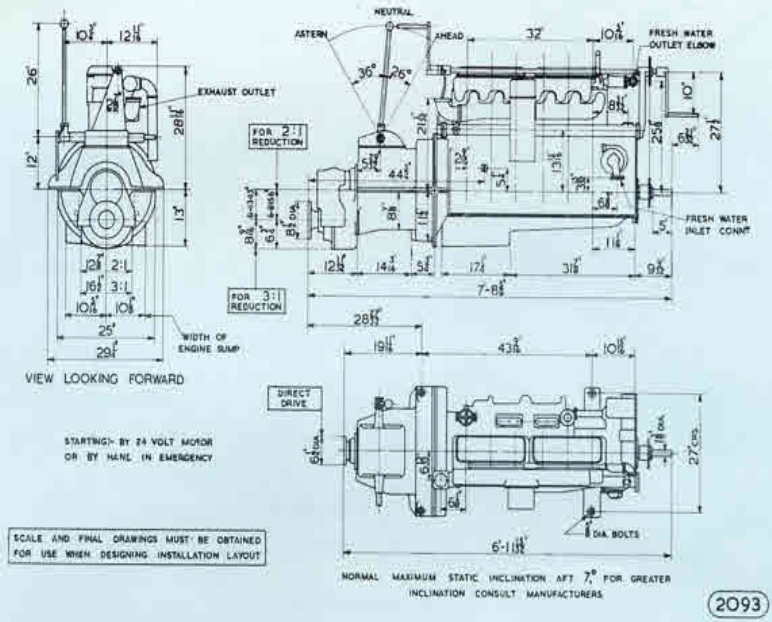
The inlet and exhaust manifolds, water circulating pump and starter motor are all positioned on the starboard side of the engine.

The cylinder block is a one-piece casting bolted to the aluminium crankcase. This adds greatly to the longitudinal rigidity and relieves the crankcase of much load and consequent distortion due to cylinder gas pressure, etc. The crankshaft is not hardened and runs in seven white-metal-lined bearings and one roller bearing at the forward end. The aluminium alloy pistons are of GARDNER manufacture and carry two pressure rings and one oil control ring. The four bolt connecting rods are of 'H' section; the big end bearings being fitted with steel shells, pre-finished and lined with specially surfaced copper lead.

The normal method of starting is by 24 volt electric starter but the decompression device and chain starting arrangement enable the engine to be readily started by hand in case of emergency.

Every engine complete with its Reversing Gear and, as necessary, its Reduction Gear, is fully tested when coupled to a dynamometer and no unit is passed off test until all aspects of its performance complies meticulously with our requirements in respect of power and fuel consumption, etc.

6LX TYPE ENGINE AND Nº 2UC REVERSE GEAR WITH DIRECT DRIVE, 2:1 AND 3:1 REDUCTION GEAR



LEADING DIMENSIONS
6LX MARINE PROPULSION ENGINE
GENERAL DATA and POWER OUTPUT

These units comprising engine, reverse gear and reducing gear, are of ALUMINIUM construction for ALL purposes. They are suitably protected from corrosion to specification accepted by the Royal National Life-Boat Institution.

BORE		STROKE		No. OF CYLINDERS	SWEPT VOLUME		DRAWING No.
Inches	m.m.	Inches	m.m.		Cu. Ins.	Litres	
4¾	120·65	6	152·40	SIX	638	10·45	14123

MARINE PROPULSION APPLICATIONS	B.H.P.	R.P.M.	Approximate Weights		
			Direct Drive	2:1 Red Gear	3:1 Red Gear
Heavy Duty Commercial Craft	110	1300	2480 lb. 22·5 lb/bhp. 1125 Kg.	2620 lb. 23·8 lb/bhp. 1188 Kg.	2660 lb. 24·2 lb/bhp. 1206 Kg.
Yachts, Cruisers, Auxiliary powered Vessels,etc. as distinct from commercial craft.	127	1500	2480 lb. 19·5 lb/bhp. 1125 Kg.	2620 lb. 20·6 lb/bhp. 1188 Kg.	2660 lb. 21·0 lb/bhp. 1206 Kg.
High Speed Craft	144	1700	2368 lb. 16·5 lb/bhp. 1074 Kg.	2508 lb. 17·5 lb/bhp. 1138 Kg.	2548 lb. 17·7 lb/bhp. 1156 Kg.

The above tables give the powers developed at normal atmospheric temperature and pressure. They are Nett Values and represent installed performance except for deductions on account of any auxiliaries or inadequate induction or exhaust systems.

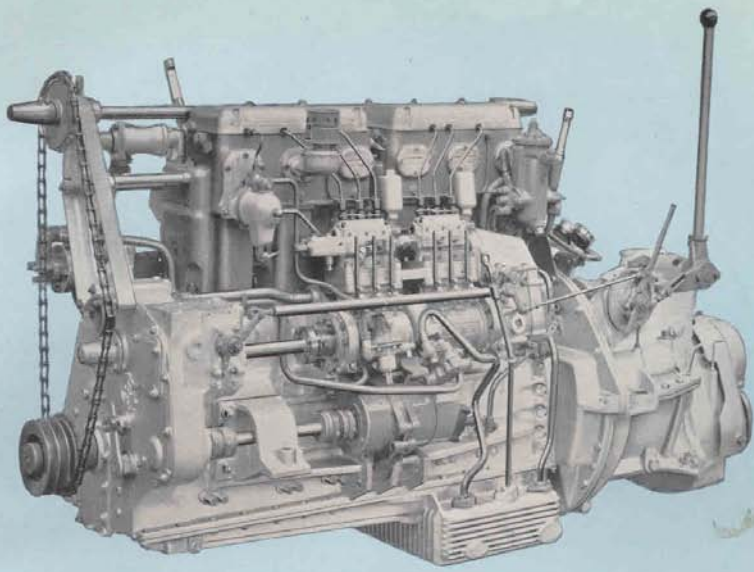
For adverse climatic conditions engines are de-rated in accordance with the engine Instruction Manual.

The weights quoted include :—

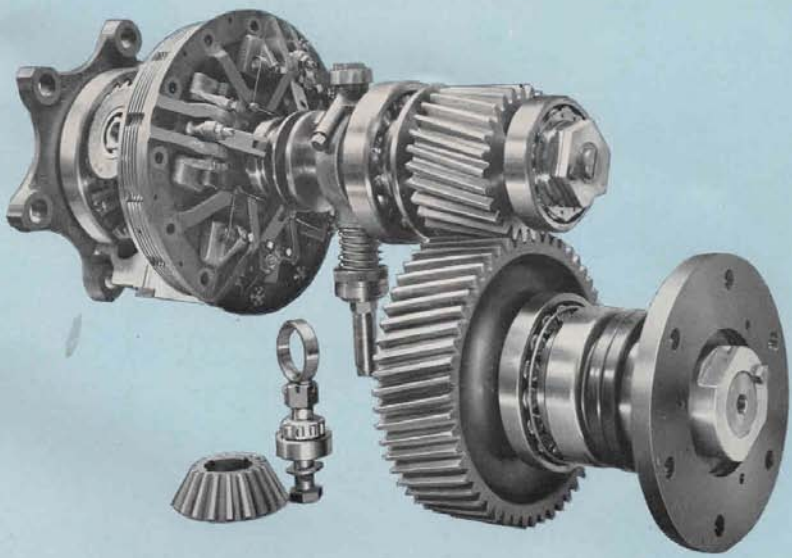
1300 and 1500 r.p.m. units : Hand Starting equipment only and heavy design flywheel.

1700 r.p.m. units : Electric Starting equipment only and light design flywheel.

GARDNER 6LX marine diesel engine



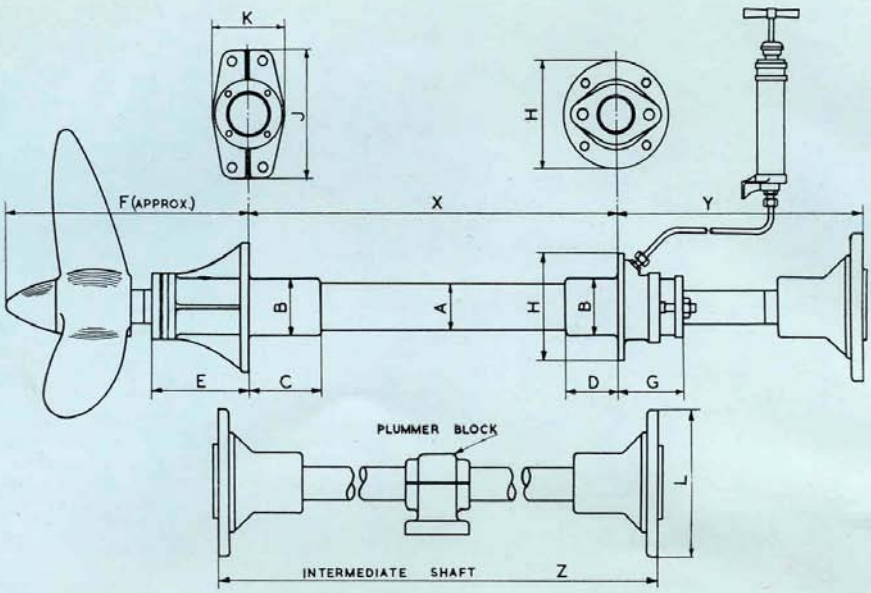
6LX marine propulsion engine with 2:1 Reversing and Reduction Gears, hand starting arrangement, also electric starting. The lubricating oil cooler and oil circulating pump, also Vee belt driving pulleys for Heat Exchanger pump are also illustrated.



Reversing Gear Running Gear specially arranged to show double-taper roller thrust bearings, Reduction Gearing, oil pump, seals and ahead clutch loading levers.

GARDNER 6LX marine diesel engine

APPROXIMATE DIMENSIONS OF STERNGEAR FOR 6LX ENGINES



PROPELLER & STERNGEAR SIZES

DIMENSIONS OF BRONZE STERNGEAR WITH WHITEMETAL BEARINGS FOR WOODEN VESSELS.

DESCRIPTION	A	B	C	D	E	F	G	H	J	K	L
DIRECT DRIVE	3"	3 3/8"	4 3/8"	3 3/8"	6"	16"	4 1/8"	7 1/8"	7 1/8"	4 1/4"	6 1/2"
2:1 REDUCTION	3 1/2"	3 7/8"	6 7/8"	5 1/4"	6 1/2"	17 1/2"	5"	7 3/4"	8 3/4"	5"	8 1/2"
3:1 GEAR	4"	4 3/4"	8 1/2"	5 3/4"	6 3/4"	19 3/4"	5 1/4"	9"	10 1/2"	6 3/4"	8 1/2"

DIMENSIONS X & Y MUST BE SUPPLIED BY CLIENTS WHEN ORDERING STERNGEAR, ALSO DIMENSION Z IF INTERMEDIATE SHAFT IS REQUIRED.

SHAFT LENGTHS EXCEEDING 6 FEET SHOULD BE SUPPORTED BY A PLUMMER BLOCK.

DIRECT DRIVE ENGINES REQUIRE L.H. PROPELLERS, REDUCING GEARS R.H. PROPELLERS.

DESCRIPTION	DIRECT DRIVE	2:1 REDUCTION	3:1 REDUCTION
3 BLADE PROPELLER DIAMETER 1300 R.P.M.	26"	35"	43"
" " " " 1500 R.P.M.	23 1/2"	31 1/2"	38"
" " " " 1700 R.P.M.	23"	31"	37"
4 BLADE PROPELLER DIAMETER 1300 R.P.M.	—	32 1/2"	40"
" " " " 1500 R.P.M.	—	30"	35"
" " " " 1700 R.P.M.	—	—	35"
BRONZE TAILSHAFT DIAMETER	2 1/8"	2 3/4"	3 1/8"
STEEL INTERMEDIATE SHAFT DIAMETER	2"	2 1/2"	2 3/4"

PROPELLER SIZES ARE APPROXIMATE AND MAY VARY ACCORDING TO THE LINES OF THE VESSEL.

FOUR BLADE PROPELLERS ARE NOT RECOMMENDED FOR SHAFT SPEEDS ABOVE 700/800 R.P.M.

REDUCTION GEARS REFERRED TO AS 2:1 & 3:1 ARE ACTUALLY 1·962:1 & 2·962:1 RESPECTIVELY.

2092

CONFIRMATION must be obtained before working to Sterngear Dimensions

SPECIFICATION

STANDARD MARINE ENGINE

Standard equipment for the 6LX Marine Propulsion Diesel Units comprises engine with light alloy crankcase and raised hand starting gear with two handles, centrifugal type water circulating pump with thermostatically operated temperature control, oil cooler and circulating pump, water and oil thermometers, sump emptying pump, oil pressure gauge, steel flywheel, engine mounted fuel filter, additional Duplex type fuel filter, friction disc type speed control interlocked with gear control, exhaust manifold elbow, engine supporting feet, unit construction type endplate for No. 2 reverse gear with either direct drive or 2:1 or 3:1 reducing gear, No. 5 bronze water strainer, stopping lever, decompression levers, engine lifting eyebolts, companion flanges for coolant inlet and outlet and exhaust outlet, box containing tools, spare parts, Instruction Books and Spare Parts Catalogue.

ADDITIONAL EQUIPMENT SUPPLIED WHEN SPECIFIED

1. 2 : 1 (actually 1·96 : 1) or 3 : 1 (actually 2·96 : 1) ratio propeller shaft reducing gears.
2. 24 volt electric starting equipment with 100 amp. hour battery and 216 watt lamp load dynamo, regulator and suppressors.
3. Temperate, Sub-tropical or Tropical fresh water cooling equipment comprising Heat exchanger, Bronze sea water pump and drive, seacock and strainer and air separating vessel.
4. Temperate, Sub-tropical or Tropical keel cooler and air separating vessel.
5. Fresh water header tank for heat exchanger or keel cooler.
6. Opposite Hand Rotation of engine.
7. Remote reading tachometer, mechanical type with 12 ft. drive.
   Remote reading tachometer, mechanical type with hour meter.
   Remote reading tachometer, electrical type.
8. Separate oil pressure operated hour meter with switch, etc.
9. Remote reading water thermometer and 15 ft. tubing.
10. Remote reading oil thermometer and 15 ft. tubing.
11. Remote reading oil pressure gauge and 12 ft. tubing.
12. Switch only for low oil pressure warning.
13. Switch only for high water temperature warning.
14. GARDNER single lever hydraulic mechanical remote control for reverse gear and engine speed—single engine set.
    GARDNER single lever hydraulic mechanical remote control for reverse gear and engine speed—twin engine set.
15. GARDNER hydraulic remote control for reverse gear only.
16. Armstrong-Gardner hydraulic remote control for engine speed only.
17. Deck hand lever only for remote reverse gear control.
18. Fleetwood push rod operated speed control.
19. Remote engine stopping control.
20. Vertical bend on manifold and 3 ft. of flexible metallic exhaust pipe.
21. Exhaust silencer—dry absorption type.
22. Exhaust silencer—dry type mounted in GARDNER ventilating funnel.
23. Exhaust silencer—water jacketed type with water injection bend.
24. Engine mounted bilge pump (not available with keel coolers).
25. Giljector bilge and general service pump unit with clutch.
26. Engine mounted fuel lift pump arrangement.
27. Average set of installation pipes and fittings.
28. Flexible coupling on crankshaft for winch drive or power take-off.
29. Flexible coupling on crankshaft with extension shaft and two bearings.
30. Dog clutch only for winch drive.
31. Alignment shims and jacking screws for engine feet.
32. Sump emptying pump for reverse and reducing gear.
33. Half coupling for tailshaft, rough bored.
34. Electric motor driven ventilating fans for the supply of and extraction of air from engine room; with or without weatherproof cowls.
35. Lloyds (or M.O.T.) survey and test on engine for commercial craft.
    Lloyds (or M.O.T.) survey and test on engine for yachts.
    Lloyds (or M.O.T.) survey and test on sterngear, including calculations.
    Lloyds (or M.O.T.) survey and test on fresh water cooling equipment.
    Clients inspection and tests at Works.
36. Sterngear and propeller, etc.
37. Clutch only for use with V.P. propeller—direct drive.
    Clutch only for use with V.P. propeller—2 : 1 reducing. (Actually 1·96 : 1).
    Clutch only for use with V.P. propeller—3 : 1 reducing. (Actually 2·96 : 1).
38. Packing for shipment and delivery F.O.B.

NOTE—Item 2. **Larger dynamos capable of carrying lamp loads of 384, 720 and 1008 watts are available together with the appropriate battery. These can be supplied when specified in place of the 216 watt lamp load machine and 100 amp hour battery.**

Norris, Henty & Gardners, Ltd., reserve the right to modify specifications at any time without notice.

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GARDNER ENGINES (SALES) LTD.

Printed in England.

Publication No 748

The circuit is completed between the two fixed contacts by means of the circular moving contact "D" which isolated on the spring-loaded plunger "E" and is operated by pressing the moulded knob "F".
The fixed contacts are end milled when they are assembled in the body to ensure good alignment with the Cone-shaped metal moving contact. Large cable connecting tags are provided.
In regard to *the maintenance of this type of switch*, it is necessary to keep the terminals and the surface on which they are mounted quite free from dirt damp,or oil.
The terminal nuts H must be tight and care taken that the cable tags "J" do not twist and touch one another. A smear of vaseline should be applied to the main plunger "E", as necessary.
The contacts can be inspected after removing the top cover "K" with its fixing screws L. The contacts can be cleaned with spirit or fine carborundum (not emery) paper, unless badly pitted, when they should be renewed.

Fig. 310 illustrates *the solenoid pattern of starter switch* which is used for *axial starters*
This is a simple two step switch,such that at the first step the switch complete the circuit to the shunt and auxiliary field windings allowing a small current to pass
sufficient to give the starter armature its axial movement, thus gently but firmly engaging the pinion the the teeth on the flywheel. When this engagement has taken place the second circuit is completed, allowing the main current to flow and the starter to develop its maximum power.
Referring to Fig. 295, when the starter button is pressed, the magnetic field set up in the switch windings draws in the armature O until the first contact is closed and the catch G rests on the step in the trigger M. This position is held until the

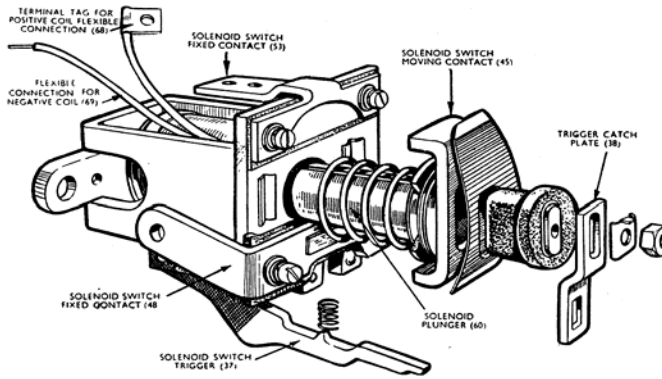


Fig. 310.—Typical Solenoid Starter Switch (A.E.C.).

trigger is lifted by the trip plate on the armature during its travel and thus allows the second contact to close and the main current to pass.

Dismantling and Reconditioning Typical Solenoid Switch

As an example of the general method of dismantling and reconditioning the solenoid type of starter switch, that of the C.A.V. make illustrated in Fig. 311) has been selected. This pattern is used on certain Leyland vehicles

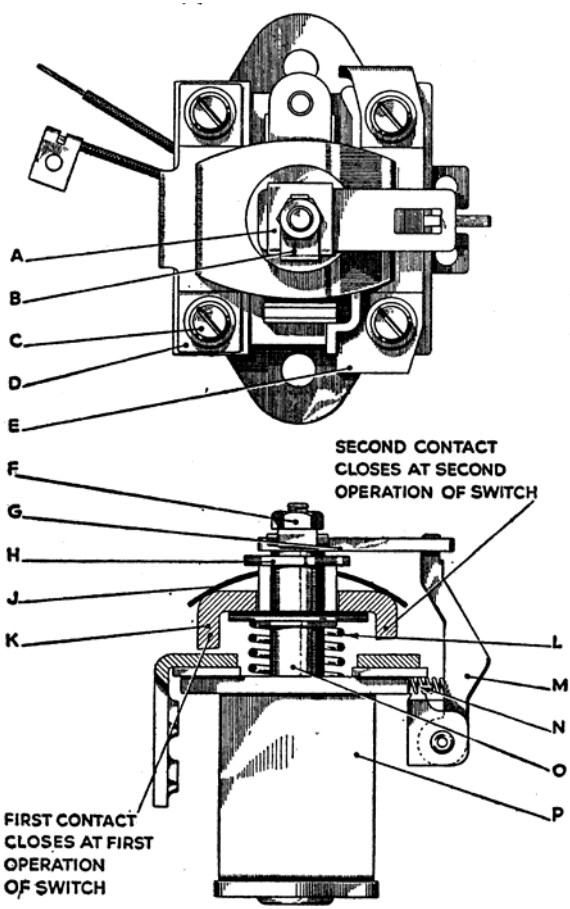


Fig. 311.—The C.A.V. Solenoid Starter Switch as used on some Leyland Vehicles.

A, Catch-holding Plate. B, Locking Washer. C, Contacts Retaining Screws. D, Fixed Contact Plate. E, Plate. F, Securing Nut. G, Catch. H, Insulating Bush. K, Bridge Piece. L, Spring. M, Trigger. N, Trigger Spring. O, Armature. P, Casing.

To Dismantle Switch.— To dismantle switch, release locking washer B (Fig. 311), remove nut F, catch-holding plate A' trigger catch G, bridge piece K with flat spring and insulating washer. Take care that trigger spring N does not fall out when catch is removed.

Note position of washers Q and R (Fig. 312), which are used for adjustment. The washer S acts as a spigot for return spring.

Remove fixed contacts by taking out retaining screws C (Fig- 3I2)

If contacts are dirty, clean with spirit or fine carborundum paper. If contacts are badly pitted, reface

When refacing don't remove more than 1/64 in. The faces must be at an angle of 3deg 49 minuites and in the same plane as shown in Fig. 313.

New fixed contacts are supplied un machined and must be faced up in position on the switch Don't use a file Or coarse abrasive. Check pressure of return spring L. When compressed to 1/2 in. length, it should have a pressure of 5 Ib. ± 5 ozs.; renew if not within limits. Check pressure of trigger spring; it should have a pressure of 12 1/2 to 16ozs. when compressed to 7/32 in.

Check that insulating bush H is an easy fit in bridge piece and is not disturbed. If winding is damaged or broken, fit new one. Lightly smear the plunger 0 with vaseline at point of entry into body, also at point of contact between flat spring and bridge piece

Reassembly and Adjustment.

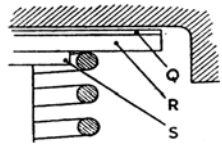
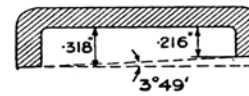


Fig. 312.



CONTACT FACES TO LIE IN SAME PLANE
Fig. 313.

If contacts have been refaced, air gaps will require adjustment. Adjusting washers Q, and R (Fig. 312) must be removed and replaced until correct air gaps are obtained. Washers available are -004, -008, and -012 in. thick.

The air gaps should be as follows:

First contacts -040 in. ± -004 in.
Second contacts -142 in. ± -008 in.
Trigger clearance -079 in. ± -004 in.

Fit new locking washer B (Fig. 311) for the armature nut.

Testing Solenoid Switch.

After assembly apply the following tests with the switch in a horizontal position:

Force to overcome return spring in " Off" position, 5 Ib. ± 5 ozs.

Force to overcome return spring in " On " position, 29 Ib. ± 2 Ib.

Force to overcome spring tension of trigger M applied at peak of tripping face (Fig. 311) with switch in " Off" position, 16 ozs. ± i| ozs.

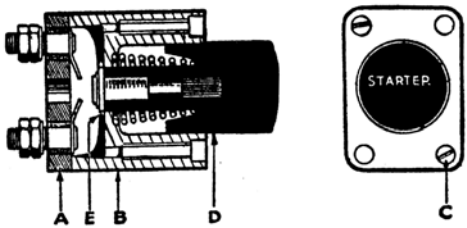


Fig. 314.—Typical Starter Button Switch.

Switch must operate on both contacts at 12 volts ± 1 volt.

Give switch a test of a few seconds duration at twice normal voltage to ensure that trigger operation is correct.

Faulty assembly or rounding of step will cause the catch to slip. Keep the terminal nuts well tightened. Take care not to twist the cable sockets so that they jam against the small insulation cap, otherwise there is a danger of distorting the plunger bearing, with a consequent sticking of the plunger action.

Remove occasionally the screwed cap and plunger, smear the brass stem of the plunger with vaseline and replace.

Starter Button Switch

The switch used for energising the main or solenoid switch takes only a low current, and can therefore be made quite light. A typical switch is shown in Fig. 314. It consists of a moulded insulator A, secured to the metal body B by means of two countersunk screws G. The plunger is shown at D. When pushed to the left against the spring,the central metal member E bridges the contact strips to which the terminals marked " plus " and "minus" are attached, and thus completes the circuit.

This type of switch must not, of course, be used to close or break main starter circuits, but only for the solenoid currents.

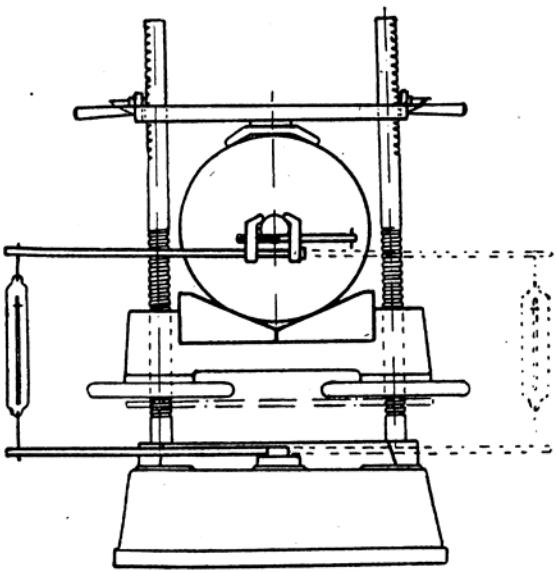


Fig. 315.—The Newton Test Bench and Torque Arm for Testing Starter Motors.

Testing Starting Motors

After a starting motor has been overhauled, or in cases where it is suspected that the output has fallen off, it is advisable to test the power of the starting motor.

The usual arrangement is to fit the motor into some kind of clamping device, or cradle, and to measure the power output by means of a mechanical brake, or dynamometer, fitted to the *casing*. The principle of this method is that of measuring the turning moment, or torque, on the motor casing, this torque being equal to that of the armature shaft,although it is opposite in the directional sense. Fig. 315 illustrates another convenient method of measuring using the Newton test bench. It will be seen that the starting motor is held rigidly in the coupling vice provided. A special torque arm is supplied and is connected in the manner indicated to the armature shaft.

Upon depressing the special starting switch provided, the starting torque is at once shown by the spring balance reading. A comparison of this "lock torque reading-with that of a standard starting motor will show at once whether the output of the motor under test is correct in value.

Locating Faults in the Starting-motor System

(a) **Motor Fails to Operate**.—Look for a *break or disconnection* in the leads from battery or to frame; see that battery terminals are not loose. *The battery may be run down*.

A *broken armature winding* will also cause motor failure. Test by placing

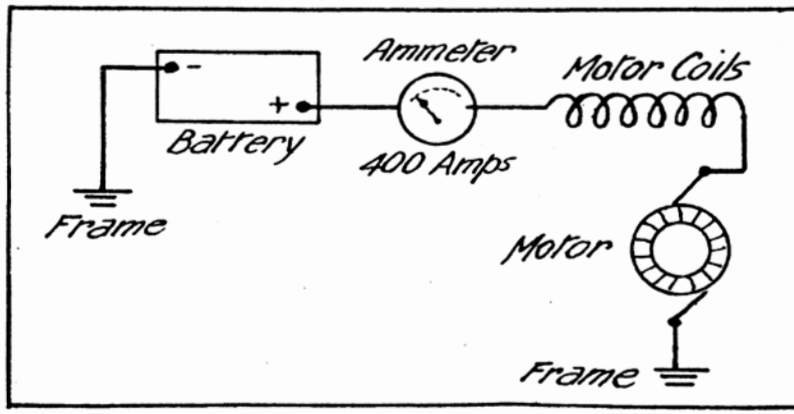


Fig. 316.—Test for Broken Armature Winding.

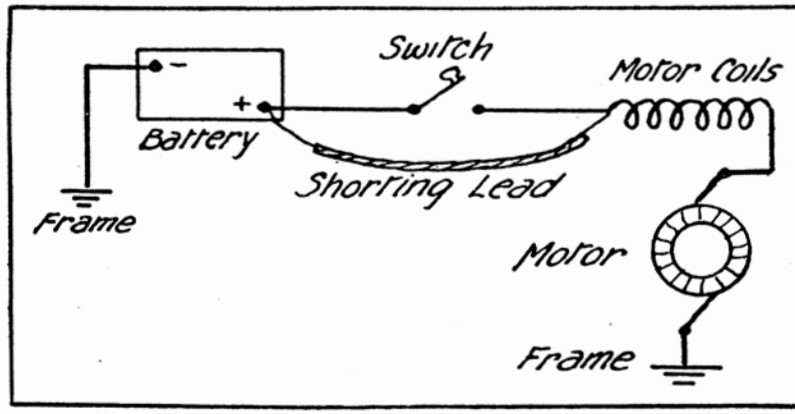
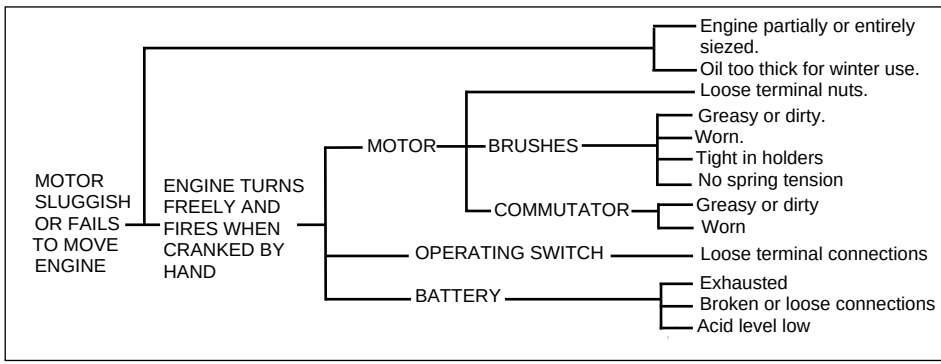


Fig. 317.—Test for Defective Switch.



ammeter in series with a freshly charged battery and armature (Fig. 316) ;

the motor should be rotated so as to test each commutator pair of segments
The starting switch may not be operating; test by short circuiting with a length of stout cable as shown in Fig 317
The engine may be seized or too stiff to operate, or the car may be in gear.
(b)**Motor Works Sluggishly**.-If the engine turns freely and fires when cranked by the starting handle this shows that? Is certainly the starting-motor system at fault. The following are the likely causes
Loose terminals on the battery, motor, or frame
Commutator dirty, or mica too high; worn commutator
Brushes greasy, not bedding properly' sticking in holders. No spring tension
The battery may be partially exhausted.
The switch terminals may be loose.

This concludes the Starter Motor extract from the Modern Motor Engineer published in 1952

☺ Welcome to new members ☺

Mr G Bowler from Middlesex	3L2
Mr M Griffin from Buckinghamshire	2LW
Mr A Bowman	HF13,6LXCT
Mr P Bailey from Devon	2L2
Mr J Hodges from Cambridgeshire	3LW
Mr E W Wain from West Midlands	6LW Road 6LW iron Gen Set.
Mr T Olds from Worcestershire	3LW
Mr C.C.Taggart from Worcestershire	2LW
Mr N Ecclestone from Stoke on Trent	2L2
Mr H Belshaw from Lancashire	2LW
Mr R.M. Evans from Lichfield	2L2
Mr M Osborne from Hampshire	6LXC
Mr T Walker from Cumbria	3L2
Mr L Buxton from Yorkshire	LXB
Mr R Bryan from Warwickshire	2LW Marine
Mr J Mc Cool from Dungannon	Numerous
Mr R C Robinson from Linconshire	8LXB
Mr P Chambers from Lincoln	LX150

Annual General Meeting

Notice is hereby given for the
Ordinary Annual General Meeting of the
Gardner Engine Forum
at the
Anson Engine Museum,
Anson Road,
Poynton,
Cheshire.
SK12 1TD
on Saturday 18th April 2009 at 2.30pm.

The purpose of this A.G.M is to present accounts for the year 2008/2009 and to elect officers onto the committee.

As you are aware, the Chairman of the Gardner Engine Forum has made it known that he wishes to stand down and therefore nominations for this post together with nominations for the vacancies we will have on the committee for the positions of Treasurer,Secretary,Newsletter Editor are invited. The current incumbents of these positions agreed to take on the roles at the last A.G.M so that the forum would continue, however changes to their personal circumstances make it extremely difficult for them to allocate time to these rolls These key roles need to be filled together with the recruitment of further Committee Members. Any further nominations must be received by the Chairman no later than 14 days prior to the date of the AGM, i.e., 4th April 2009

If you have any queries relating to these roles, the Chairman would be happy to speak with you. Location would not really be an issue as most communication is carried out electronically; therefore use of a computer would be the only requirement.

The Anson Museum will be open to the public so Geoff Challinor, curator of the museum will be able to give us a working demonstration of his engines, and be on hand to talk to us about the museum.

Please contact the Chairman (contact details on the inside cover) to register your interest to attend.Tea and coffee will be provided. Any charges for this meeting will be borne by the Forum.

Events

Gardner Engine Rally 2009

Saturday 20th & 21st June
Park Head
Dudley
DY2 0XB
Entry & admission is free
Entry forms and more information available from the
Chairman, Mr Colin Paillin (Address inside front cover)
Alternately can be obtained in various formats from the website
gardnerengineforum.co.uk

Bollington Transport Extravaganza
Saturday 19th September
Gardner Engine Owners especially welcome
Contact:- George Cann for more details
07739525064 or 07625575576

Gardner Engine Forum Website

Vistors to the website will see that it has undergone some changes, as part of the ongoing development I will be creating a library of publications,in particular instruction manuals and spare parts lists, So far I have
LW General Directions, LW Parts List 2 Versions. LW Workshop Tools.
L3 General Directions.
3UC Service and Maintenance Instructions.
LX General Directions Supplement to LW Instruction Book.
LX Spare Parts Catalogue & Illustrated Supplement .
T Type Heavy Oil Catalogue.

If you have a copy of other publications, manuals or copies of brochure or correspondence from which a copy can be made and sent to me (a photo copy or scanned version) I will add it to the site.
Either email to me at gardnerengineforum@blueyonder.co.uk or post to the address inside the front cover

Steve Gray

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